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TECHNICAL MEMORANDUM

TO: Bill Bluck/HLN

FROM: Dick Glanzman/DEN

DATE: February 24, 1993

SUBJECT: Review of Lower Lake Sediment Leachate Impact Calculations
Hydrometrics, Inc. Calculations letter to Scott Brown
dated Feb. 11, 1993

PROJECT: BOI68047.RO.FK

The basic conclusion that the impacts on either Prickly Pear Creek or the groundwater downgradient of Lower Lake following the remedial action at Lower Lake is sound. The impact to Prickly Pear Creek will probably be too small to measure because both the arsenic concentration and the groundwater contribution to the creek will be too small.

The maximum impact on the groundwater downgradient of Lower Lake is, by definition, the concentration of Lower Lake itself. Therefore, if the arsenic concentration in Lower Lake is defined by the EP TOX arsenic concentration (0.09 mg/L), the maximum arsenic concentration in the groundwater would be 0.09 mg/L if Lower Lake was the only source of recharge to the groundwater system. However, as Bob points out the EP TOX arsenic concentration is a rigorous test involving grinding and agitation between particles which abrades the surface coatings and is conducted in an acidic solution which will not be present when the lake is remediated. Therefore, the arsenic concentration in the Lake will be lower.

Of more importance, however, Lower Lake is not the sole source of recharge to the groundwater system. The upgradient arsenic concentration is 0.014 mg/L based on Bob's letter. This upgradient groundwater mixes with the recharge from Lower Lake to a mixed concentration determined in groundwater from MW DH-4. Mixing lake water with the oxidized upgradient groundwater results in an adsorption of arsenic onto the aquifer particles.

We can determine the impact of both the volume mixing and the chemical reactions resulting from the mixture by comparing Lower Lake arsenic concentrations and groundwater in MW DH-4 for three sampling round results reported by Bob in this letter. The ratio of arsenic concentration in Lower Lake and in groundwater from MW DH-4 for the three events (pp. 5 and 6) was 80 ug/L/11 ug/L, 20/4, and 12/2 resulting in an average value of 6. In other words, arsenic concentrations measured in groundwater from MW DH-4 is 14, 20, and 17 percent of arsenic concentrations in Lower Lake (an average of 17 percent). Taking 17 percent of 0.09 mg/L (Lower Lake arsenic concentration) gives a arsenic concentration of 0.015 mg/L for the arsenic concentration in groundwater at MW DH-4 following remediation. This is analytically indistinguishable from the upgradient groundwater. Therefore, this calculation indicates no impact to the groundwater.


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The above analysis makes all the same assumptions made in the letter; one of these indicates that there are no changes in the permeability between the bottom of Lower Lake and the aquifer. There will be an increase in permeability at the interface resulting from the removal of approximately one foot of marsh sediments but permeability will decline to its present value as marsh sediments again begin to accumulate on the bottom of Lower Lake. Therefore, there may be a short term impact somewhat greater than the above ratios suggest but it will decline to or near upgradient groundwater arsenic concentration with time.